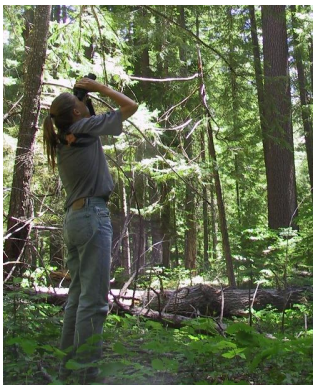
Report to the National Park Service Klamath Network on Bird Monitoring Efforts By the Klamath Bird Observatory In the Oregon Caves National Monument 2002-2006

Robert I. Frey, Keith W. Larson, and John D. Alexander
Klamath Bird Observatory, PO Box 758, Ashland, Oregon 97520



KLAMATH BIRD OBSERVATORY
www.KlamathBird.org

23 May 2007

Report to the National Park Service Klamath Network on Bird Monitoring Efforts by the Klamath Bird Observatory in the Oregon Caves National Monument 2002-2006

Robert I. Frey, Keith W. Larson, and John D. Alexander
Klamath Bird Observatory, PO Box 758, Ashland, Oregon 97520

INTRODUCTION

As a component of the National Park Service (NPS) Klamath Network Inventory and Monitoring Program (KLMN), the Klamath Bird Observatory (KBO) has conducted avian monitoring within the Oregon Caves National Monument (ORCA) since 2002. The objectives of this landbird monitoring effort include providing information useful in the description of long-term trends in composition and abundance of landbirds at ORCA. The data collected at this station compliment and are contributed to several regional and national monitoring programs and databases.

KBO cooperates with the US Forest Service's Redwood Sciences Laboratory coordinating a bird and habitat monitoring network that includes long-term constant effort bird monitoring stations where methods recommended by Partners In Flight (Hussell and Ralph 1998) are used (Alexander et al. 2004). The network encompasses the Klamath-Siskiyou Bioregion of southern Oregon and northern California and falls within the Partners in Flight (PIF) Pacific and Intermountain West Avifaunal Biomes and habitats within the Bioregion include the western Oregon conifer forest type (Altman 1999, Rich et al. 2004).

Twenty-two species detected during monitoring efforts at ORCA have been identified as conservation focal species in the PIF plans (Appendix A). The Oregon Department of Fish and Wildlife Conservation Strategy (ODFW 2006) identifies Oregon Caves-Applegate locale as a Conservation Opportunity Area in the Klamath Mountains Ecoregion and lists two species detected during ORCA monitoring efforts as conservation species (Appendix A).

Five years of monitoring at the ORCA station have resulted in a dataset that provides information on the presence, abundance, and productivity of bird species. Continued monitoring efforts will enrich this dataset, building its usefulness for analyses of species' vital signs, including productivity, survivorship, and population trends. This report provides a five-year summary of capture and survey efforts and an examination of select PIF focal species occurring at ORCA, including phenology of age-class captures and productivity rates using capture data.

METHODS

Data Collection

KBO has operated a constant effort monitoring station (CES) at ORCA since 2002. This station is located within the two hectares surrounding the Big Tree at 42˚ 05' 37" latitude, 123˚ 23' 47"

longitude. The exact location has been recorded in KBO's GIS database and the physical and habitat characteristics of the site described using the location and vegetation relevé survey method described by Ralph et al. (1993). The CES location is within a small riparian forest patch dominated by mountain alder and small moist meadows surrounded by late-seral mixed conifer forest.

The protocol implemented for conducting long-term monitoring at this CES included mist net, banding, area search surveys, vegetation surveys, and DNA and stable isotope sampling (Ralph et al. 1993, 2004). The CES efforts at ORCA began each year in late-May or early June (exact date was determined by snow-cover at this high-elevation location), at the onset of the landbird breeding season. The efforts continued into mid-October (exact date was determined by winter weather conditions), including the fall migration. Through August, the CES efforts were scheduled every10-days (Appendix B), and beginning on 1 September, efforts were scheduled once every 7-days. A mist net array of 10 nets was situated within riparian vegetation. Two area search plots were delineated, encompassing the area of the net array. Area search surveys were 20 minutes in length, with at least two surveys completed during each monitoring effort. At the conclusion of every site visit, a checklist was completed that included all species encountered through capture, surveys, and incidental observation during the visit.

Analyses

Capture rates were calculated as number of captured birds multiplied by total net hours. Capture histories were compiled for select focal species (those with consistent captures during the sampling period) from capture numbers per 10-day period for all years (2002-2006) combined, sorted by age-class throughout the sampling period. Productivity rates were calculated as the ratio of capture rates of locally produced young to breeding adults within the same year. Locally-produced juveniles were identified as those individuals having at least 50% juvenal plumage; juvenile birds lose their juvenal plumage soon after fledging. Breeders were identified as those adult individuals showing breeding condition (i.e., with a well-developed cloacal protuberance or brood patch), or those individuals captured on more than one day during the breeding season within a single year.

RESULTS AND DISCUSSION

Summary of Capture and Survey Efforts

From 2002 through 2006, 73 efforts were completed. During the 3,601 net hours, we captured 1,670 birds of 48 identified species. During these efforts, 144 area search survey were completed (Table 1 and 2).

Capture Data

Of the species captured, 15 were PIF focal species (Table 3, Appendix A). Neither of the ODFW conservation species was captured.

Phenology of Species Captured

Our examination of the phenologies of PIF focal species indicate that the Oregon Caves area is used by resident breeding species, migrant breeding species, and migrating species during post-breeding dispersals and fall migration. The western Oregon conifer habitat type of the area has been described as important for migrating songbirds (Altman 1999, ODFW 2006).

Capture data provides information about the presence of each species, and each age class, throughout the breeding and fall migration seasons. Analysis of captures grouped by ten-day period provides a visualization of the presence and absence of species by age class throughout this sampling period (Figure 1).

Of the PIF Focal Species, examples of local breeder-only species (species that only occur during the May through August breeding season) include the Pacific-slope Flycatcher and Hermit Warbler (Figures 1 and 2). Both species show a peak of capture rates within the breeding season and are absent during the fall migration. Extreme spikes of juvenile birds centered on ten-day periods 10-11 for both the flycatcher and the warbler indicate presence of fledging and/or dispersing juveniles at the site. This is supported by positive productivity rates found in these species (Table 6). Each of these species was essentially absent at the site following ten-day period 15.

Of the PIF Focal Species captures, examples of migrant-only species (species that only occur during the late-August through October migration season) include the Wilson's Warbler and Fox Sparrow. Each of these species was absent prior to ten-day period 7, with the sparrow first captured in period 9 (Figures 3 and 4). The earlier arrival of the warbler, comprised largely of adults, indicates distinct temporal migration passage for the age classes. The warbler, a Neotropical migrant, was absent after period 16. The sparrow, a short-distance migrant, was found increasing in numbers from periods 17 to 18, although comprised entirely of young birds.

Only the Dark-eyed Oregon Junco was captured throughout the sampling period, suggesting this species uses the Oregon Caves area for breeding, dispersal and migrations (Figure 5). Though the junco is not a Focal Species for this habitat or Ecoregion its higher captured rate makes it a good species for preliminary demographic analysis. A strong peak of young birds captured centered during ten-day period 10 indicated the fledging period, while a later peak of young and adults in period 16 suggests a migration passage, perhaps of another population to the north. This short-distance, often altitudinal, migrant may leave the site in winter, as falling capture numbers at the late autumn suggest. The Chestnut-backed Chickadee had juvenile capture number peaks at periods 8-9, earlier than the migrants (i.e., Western Flycatcher, Hermit Warbler and Wilson's Warbler, indicating an earlier nesting cycle, typical in resident species (Figure 6). Later in the season subsequent influxes of dispersing young are captured.

Productivity

Of the species captured, 17 included both young and adults within the same year for at least one year; for these species, productivity was calculated (Table 6). Three species, the Western (Pacific-slope) Flycatcher, Steller's Jay, and Dark-eyed (Oregon) Junco, included captures of

both young and adults within the same year in four or more years. These were utilized further analyses of productivity.

Examinations of year-to-year productivity rates for two Focal Species and another captured consistently in high numbers, the Dark-eyed (Oregon) Junco allow for a comparison of productivity rates between species. The Western (Pacific-slope) Flycatcher showed a five-year average slightly greater than 1.0, (Figure 7). The Steller's Jay and junco showed productivity averaging a rate of 1.0 over the five years (Figures 8 and 9). These results should be considered preliminary estimates of productivity and do not take into account life-time productivity or fecundity.

Data Contributions

Data collected at these stations are contributed to several large-scale bird monitoring databases. All banding data is contributed to the U.S. Geological Survey's Bird Banding Laboratory's continental-scale database. Banding data collected during the breeding season are contributed to the Institute for Bird Populations' continental-scale Monitoring Avian Productivity and Survivorship program (DeSante and Nott 2001). All Banding and survey data collected during the post-breeding and fall migration season are contributed to the hemispheric-scale Landbird Migration Monitoring Network program (Alexander and Ralph 2005). All data are contributed to the Klamath Demographic Monitoring Network (Alexander et al. 2004) and the hemispheric-scale Cornell Ornithology Laboratory's Avian Knowledge Network. Feather samples and cloacal swab samples are contributed to the University of California Los Angeles Center for Tropical Research's Population, Structure, and Conservation of Neotropical Migratory Birds program and avian influenza monitoring effort. Finally, all banding and survey data will be contributed to the National Park Service Klamath Network Inventory and Monitoring Program.

The Klamath Bird Observatory looks forward to continuing these long-term monitoring efforts, building upon the efforts of 2002-2006. Scientific names for all bird species within this report are listed in Appendix C.

ACKNOWLEDGEMENTS

We thank KBO's volunteer intern students and Oregon Caves National Monument personnel whose dedication and hard work in the field make this effort possible. Funding for this effort has been provided by the National Park Service Klamath Network Inventory and Monitoring Program and Oregon Caves National Monument. Ongoing support for this project from Daniel Sarr has been critical. A review by KBO Research Advisor C. John Ralph greatly improved this report.

Literature Cited

Alexander, J. D. and C. J. Ralph. 2005. Towards a Migration Monitoring Network in the United States. *In* Skagen, S. K., C. P. Melcher, and R. Hazlewood. 2004. Migration stopover ecology of western avian populations: A southwestern migration workshop. U.S. Geological Survey, Biological Resources Discipline, Open-File Report 2004-1452, 29 p. Available at *http://www.fort.usgs.gov/products/publications/21409/21409.pdf*

Alexander, J. D., C. J. Ralph, K. Hollinger, and B. Hogoboom. 2004. Using a wide-scale landbird monitoring network to determine landbird distribution and productivity in the Klamath Bioregion. Pp. 33-41 in K.L. Mergenthaler, J.E. Williams, and E.S. Jules (Eds.), Proceedings of the Second Conference on Klamath - Siskiyou Ecology. Copies available from Klamath Bird Observatory, PO Box 758, Ashland, Oregon, 97520.

Altman, B. 1999. Conservation strategy for landbirds in coniferous forests of western of Oregon and Washington. Oregon-Washington Partners in Flight. Copies available from Klamath Bird Observatory, PO Box 758, Ashland, Oregon, 97520.

DeSante, D. F. and M. P. Nott. 2001. An overview of the North American Monitoring Avian Productivity and Survivorship (MAPS) program. In the 2001 EURING Newsletter (Volume 3) edited by Fernando Spina, Istituto Nazionale per la Fauna Selvetica "Alessandro Ghigi". Available at *http://www.birdpop.org/DownloadDocuments/Eurinews.pdf*

Hussell, D. J. T. and C. J. Ralph. 2005. Recommended methods for monitoring bird populations by counting and capture of migrants. Partners in Flight Inventory and Monitoring Working Group. North American Bird Bander 30(1):6-20 (Available at *http://www.klamathbird.org/lammna/publications.htm)*

Oregon Department of Fish and Wildlife (ODFW) 2006. Oregon Conservation Strategy. Oregon Department of Fish and Wildlife, Salem, Oregon.

Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of field methods for monitoring landbirds. USDA Forest Service General Technical Report PSW-GTR-l44. Available at *http://www.fs.fed.us/psw/topics/wildlife/birdmon/landbird/*

Ralph, C. J., K. R. Hollinger, and R. I. Frey. 2004. Redwood Sciences Laboratory and the Klamath Demographic Monitoring Network mist-netting station management procedures. U.S. Dept. of Agriculture Forest Service Redwood Sciences Laboratory, Arcata, California. Copies available from Klamath Bird Observatory, PO Box 758, Ashland, Oregon, 97520.

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Martell, Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenburg, C. M. Rustay, J. S. Wendt, T. C. Will. 2004. Partners In Flight North American Landbird Conservation Plan. Cornell Laboratory of Ornithology. Ithaca, New York.

Figures and Tables

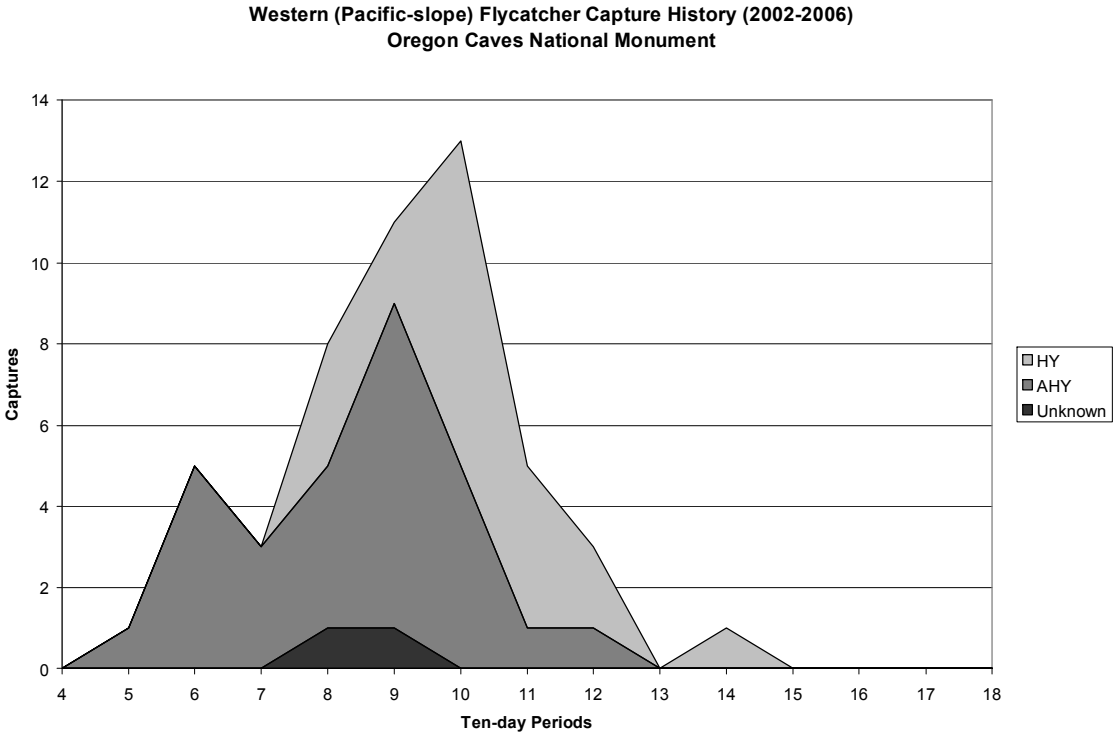


Figure 1. Pacific-slope Flycatcher captures at Oregon Caves 2002-2006 expressed as capture totals per 10-day period (see Appendix B for calendar date ranges) by age class (HY = hatching year (juvenile), AHY = after-hatching year (adult), Unknown = age class undetermined).

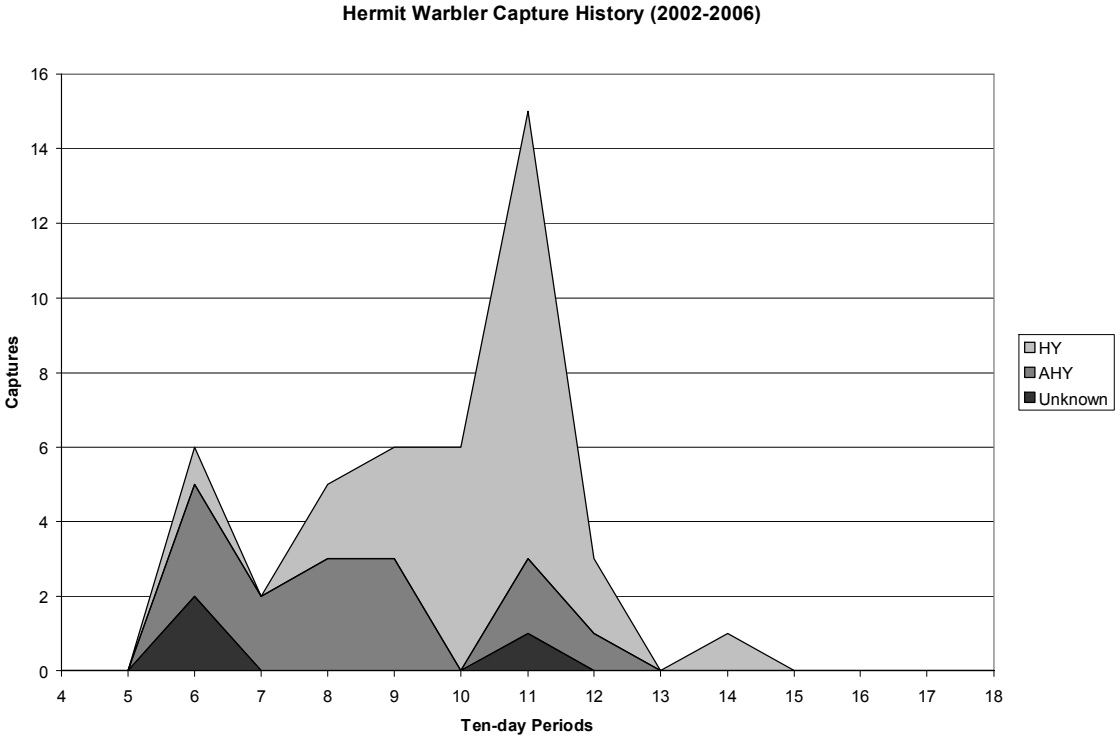


Figure 2. Hermit captures at Oregon Caves 2002-2006 expressed as capture totals per 10-day period (see Appendix B for calendar date ranges) by age class (HY = hatching year (juvenile), AHY = after-hatching year (adult), Unknown = age class undetermined).

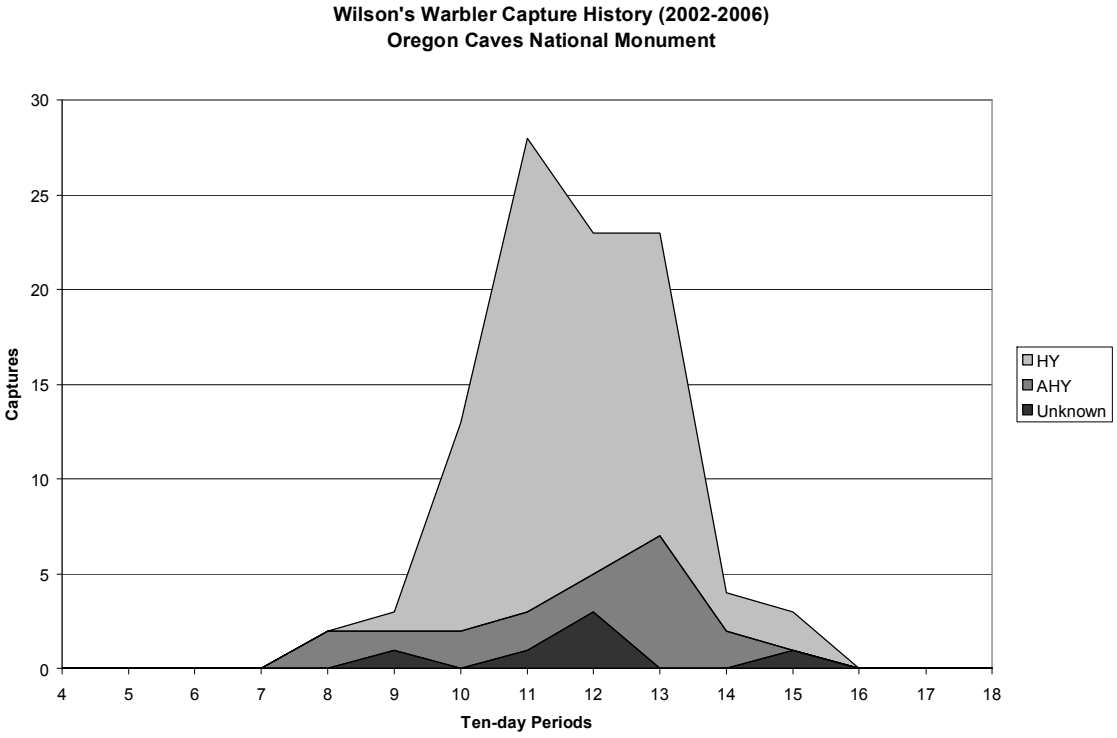


Figure 3. Wilson's Warbler captures at Oregon Caves 2002-2006 expressed as capture totals per 10-day period (see Appendix B for calendar date ranges) by age class (HY = hatching year (juvenile), AHY = after-hatching year (adult), Unknown = age class undetermined).

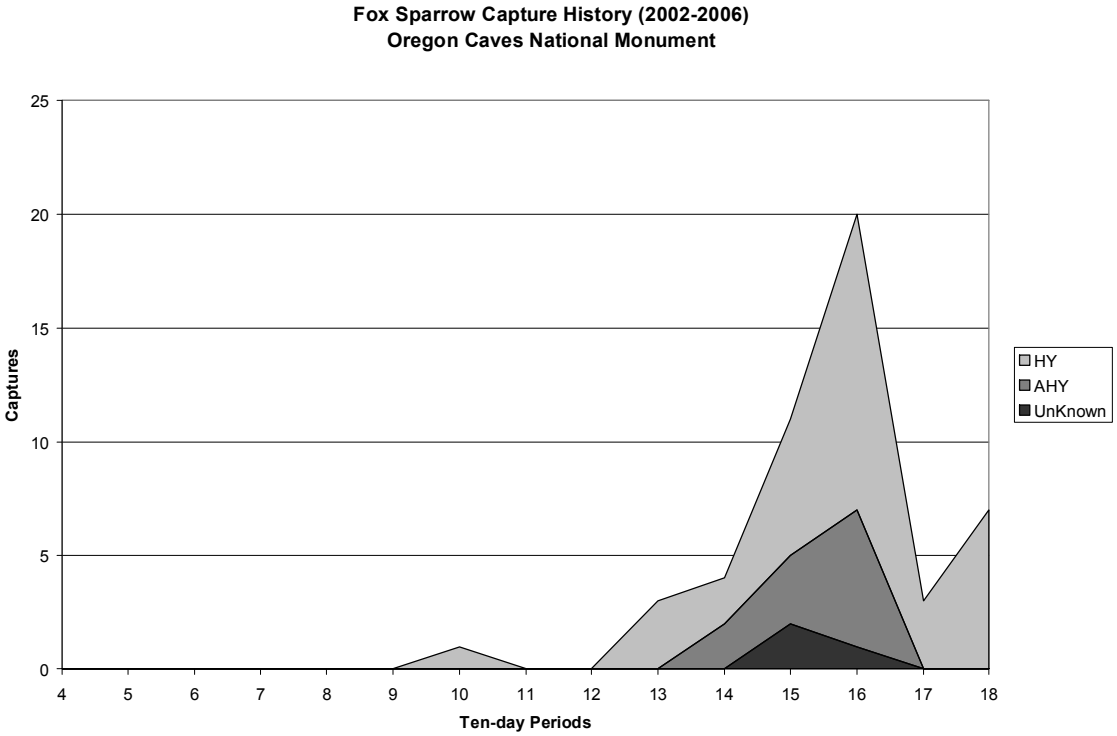


Figure 4. Fox Sparrow captures at Oregon Caves 2002-2006 expressed as capture totals per 10-day period (see Appendix B for calendar date ranges) by age class (HY = hatching year (juvenile), AHY = after-hatching year (adult), Unknown = age class undetermined).

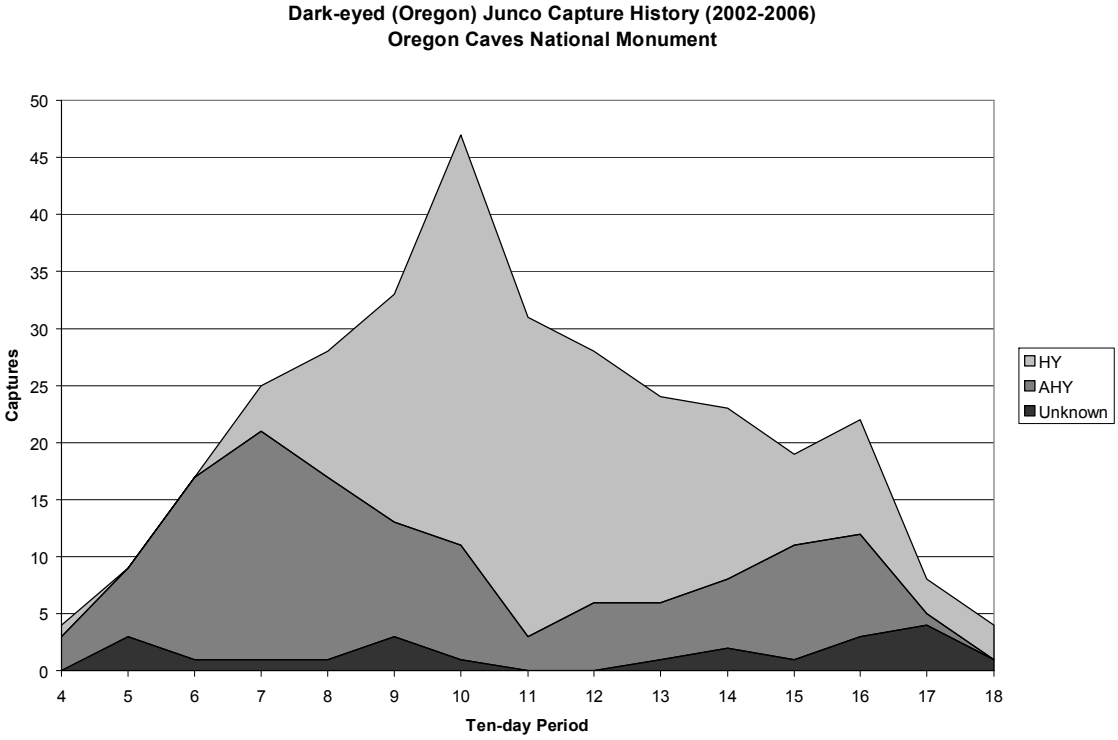


Figure 5. Dark-eyed (Oregon) Junco captures at Oregon Caves 2002-2006 expressed as capture totals per 10-day period (see Appendix B for calendar date ranges) by age class (HY = hatching year (juvenile), AHY = after-hatching year (adult), Unknown = age class undetermined).

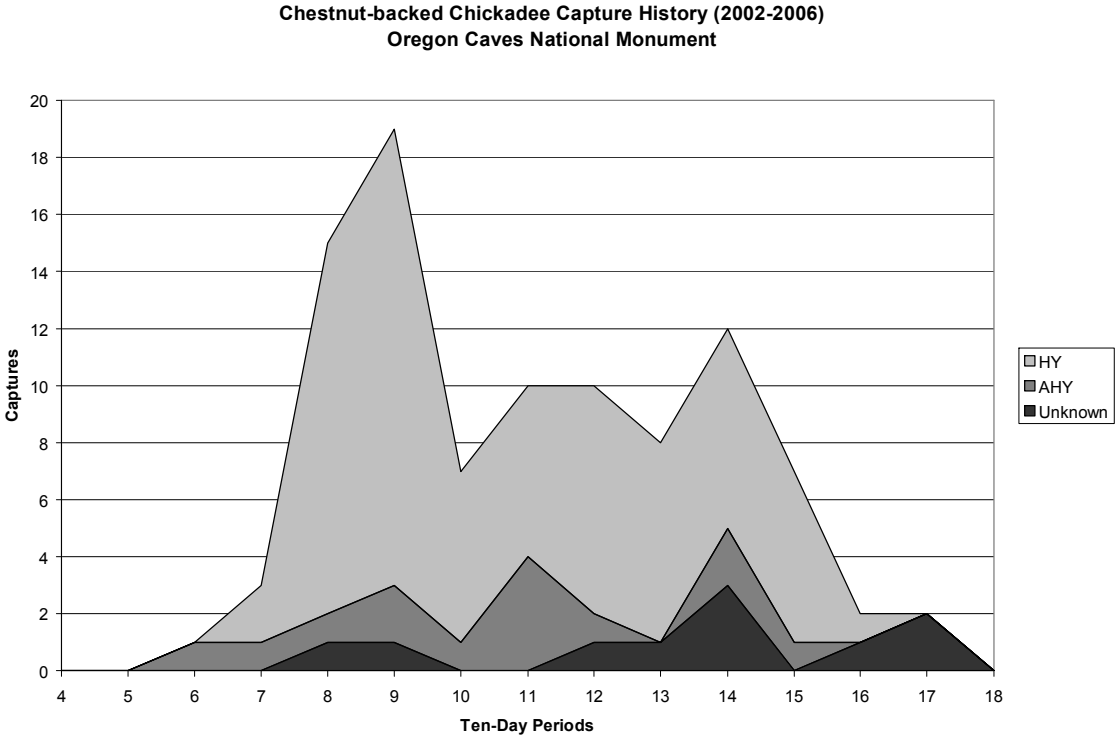


Figure 6. Chestnut-backed Chickadee captures at Oregon Caves 2002-2006 expressed as capture totals per 10-day period (see Appendix B for calendar date ranges) by age class (HY = hatching year (juvenile), AHY = after-hatching year (adult), Unknown = age class undetermined).

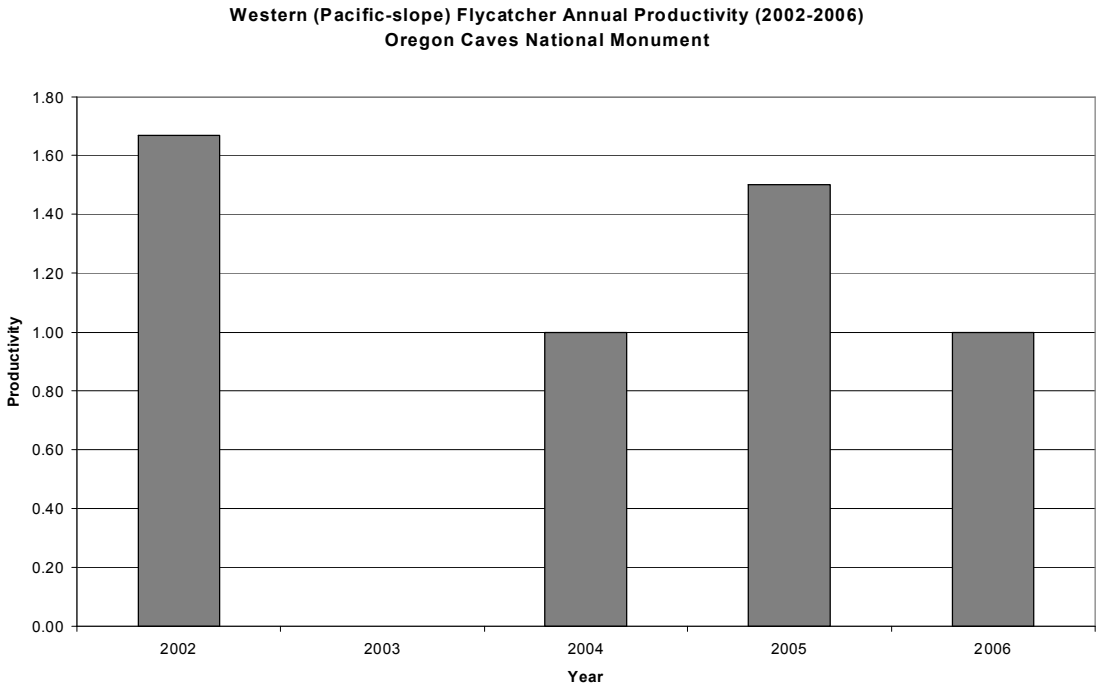


Figure 7. Productivity of Western (Pacific-slope) Flycatchers captured at the Klamath Bird Observatory constant effort monitoring station at Oregon Caves National Monument 2002-2006 by year, calculated as the ratio of capture rates of locally produced young to capture rates of breeding adults captured [capture rate calculated as birds captured per net hour; net hour = number of 12 m nets operated multiplied by time operated in hours].

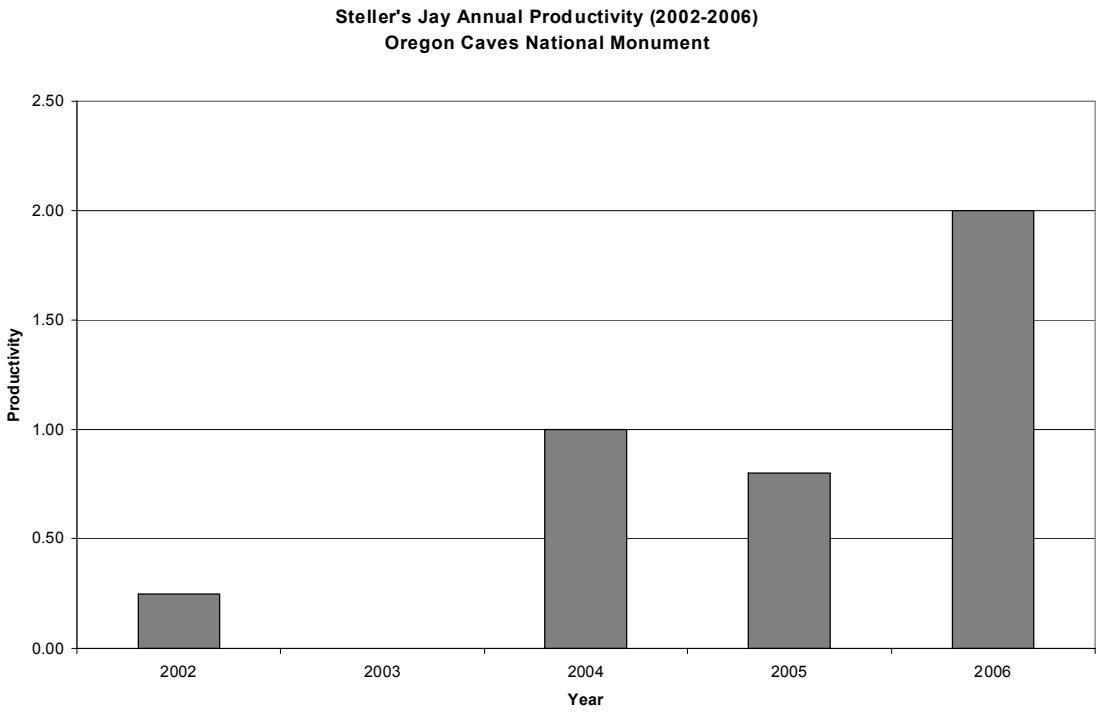


Figure 8. Productivity of Steller's Jays captured at the Klamath Bird Observatory constant effort monitoring station at Oregon Caves National Monument 2002-2006 by year, calculated as the ratio of capture rates of locally produced young to capture rates of breeding adults captured [capture rate calculated as birds captured per net hour; net hour = number of 12 m nets operated multiplied by time operated in hours].

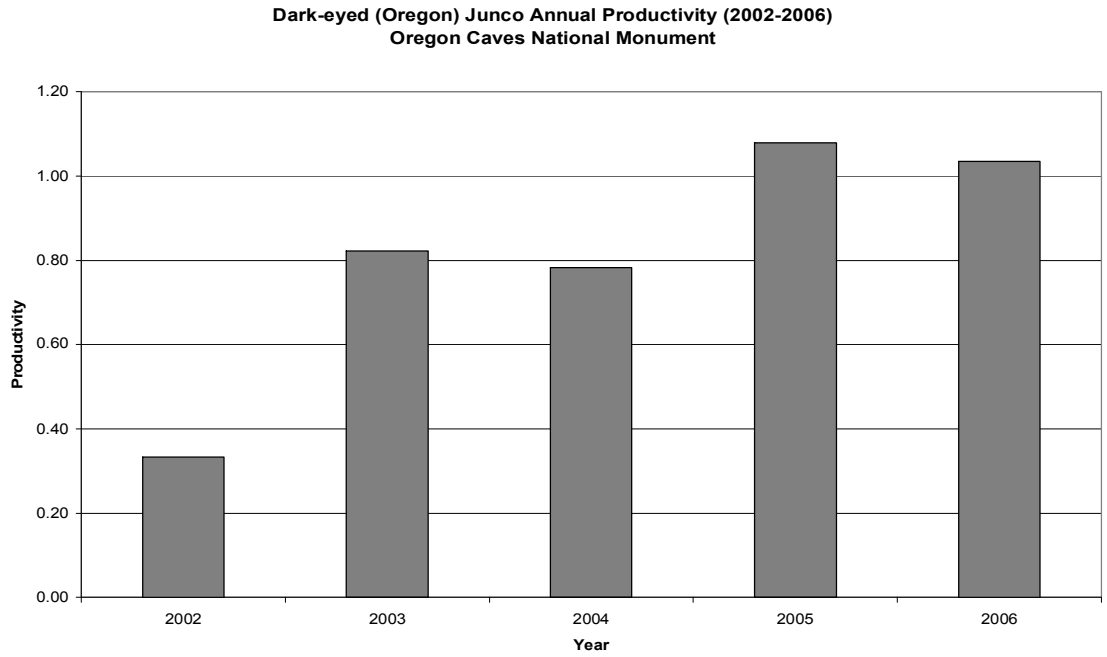


Figure 9. Productivity of Dark-eyed (Oregon) Juncos captured at the Klamath Bird Observatory constant effort monitoring station at Oregon Caves National Monument 2002-2006 by year, calculated as the ratio of capture rates of locally produced young to capture rates of breeding adults captured [capture rate calculated as birds captured per net hour; net hour = number of 12 m nets operated multiplied by time operated in hours].

Table 1. Effort summary of the Klamath Bird Observatory's constant effort monitoring station at Oregon Caves National Monument by all-season, breeding season, and fall migration season 2002-2006 by year and season. [Efforts = number of visits to each site; Net Hours = number of 12 m nets operated multiplied by time operated in hours; Average Daily Captures = average total captures per effort-day; captures per net hour calculated as birds captured per net hour].

Year	Efforts	Banded Birds Recapture	New Banded Birds	Unbanded Birds	Total Captured Birds	Net Hours	Average Daily Captures	Captures per Net Hour	Area Search Surveys
Breeding Season									
2002	8	28	200	29	257	397.9	32.1	0.65	15
2003	9	38	179	24	251	444.8	27.9	0.56	17
2004	5	19	129	16	179	247.0	35.8	0.72	10
2005	7	27	161	16	211	350.8	30.1	0.60	13
2006	9	21	123	22	166	448.0	18.4	0.37	18
Fall Migration Season									
2002	7	10	101	5	116	352.7	16.6	0.33	14
2003	8	18	67	2	96	371.7	12.0	0.26	16
2004	8	12	72	14	113	394.2	14.1	0.29	16
2005	6	28	132	11	179	294.5	29.8	0.61	12
2006	6	9	90	3	102	298.9	17.0	0.34	13
All-Season									
2002	15	38	301	34	373	750.6	24.9	0.50	29
2003	17	56	246	26	347	816.5	20.4	0.42	33
2004	13	31	201	30	292	641.2	22.5	0.46	26
2005	13	55	293	27	390	645.3	30.0	0.60	25
2006	15	30	213	25	268	746.9	17.9	0.36	31
Totals (2002-2006)	**73**	**210**	**1,254**	**142**	**1,670**	**3,600.5**	**22.9**	**0.46**	**144**

Table 2. Total captures at Klamath Bird Observatory's constant effort monitoring station in the Oregon Caves National Monument 2002-2006 by species and year.

Species	Year 2002	2003	2004	2005	2006	Total
Allen's Hummingbird	2	1	2	1		**6**
American Robin		4	2	1	3	**10**
Yellow-rumped (Audubon's) Warbler	2	1	3	10	6	**22**
Black-headed Grosbeak	5	6	4	16	2	**33**
Black-throated Gray Warbler				5	1	**6**
Brown Creeper	4	2	1	1	3	**11**
Cassin's Vireo		1	2	1	5	**9**
Chestnut-backed Chickadee	16	26	17	45	5	**109**
Downy Woodpecker			1			**1**
Dusky Flycatcher	2			1	2	**5**
Empidonax Flycatcher Sp.			3	2		**5**
Fox Sparrow	22	7	10	10		**49**
Golden-crowned Kinglet	19	12	8	22	20	**81**
Golden-crowned Sparrow	8		3	2	2	**15**
Gray Jay	9	1	1	1	1	**13**
Green-tailed Towhee		1	1			**2**
Hammond's Flycatcher	1		1	5		**7**
Hermit Thrush	13	9	11	12	7	**52**
Hermit Warbler	8	13	8	11	4	**44**
House Wren		1			1	**2**
Hummingbird Sp.					1	**1**
Hutton's Vireo					1	**1**
Lazuli Bunting	1					**1**
Least Flycatcher			1			**1**
Lincoln's Sparrow			1			**1**
MacGillivray's Warbler	35	30	20	33	20	**138**
Mountain Chickadee				1		**1**
Nashville Warbler	30	22	11	33	16	**112**
Orange-crowned Warbler	7	6	4	5	3	**25**
Dark-eyed (Oregon) Junco	100	100	66	131	80	**477**
Western (Pacific-slope) Flycatcher	16	5	10	15	10	**56**
Pine Siskin				2		**2**
Purple Finch	1					**1**
Red-breasted Nuthatch	12	16	9	10	4	**51**
Red-breasted Sapsucker	5			3	1	**9**
Norhern (Red-shafted) Flicker		1	1		1	**3**
Ruby-crowned Kinglet	5	4	1	7	1	**18**
Ruffed Grouse					1	**1**
Rufous Hummingbird	16	10	4	8	10	**48**
Selasphorus Hummingbird Sp.	4			1		**5**
Steller's Jay	11	3	8	14	6	**42**
Swainson's Thrush	4	8	12	13	3	**40**
Townsend's Solitaire	1					**1**
Townsend's Warbler	1	1	2	7		**11**
Varied Thrush		2	7	1	2	**12**
Warbler Sp.				1		**1**
Warbling Vireo		1	2	1	1	**5**
Western Tanager				3		**3**
Wilson's Warbler	9	27	13	26	27	**102**
Winter Wren	5	3	1	5	3	**17**
Yellow Warbler				1	1	**2**
Grand Total	**374**	**324**	**251**	**467**	**254**	**1,670**

Table 3. Age classes of conservation status birds [*i.e.*, Partners In Flight Focal Species (Altman 1999), and Watch List and Stewardship Species (Rich et al. 2004)] captured at the Klamath Bird Observatory's constant effort monitoring station in the Oregon Caves National Monument by year [HY = hatching year (juvenile), AHY = after-hatching year (adult)].

	2002		2003		2004		2005		2006		Totals	
Species	HY	AHY	HY	AHY	HY	AHY	HY	AHY	HY	AHY	**HY**	**AHY**
Black-throated Gray Warbler							5		1		**6**	**0**
Brown Creeper	4		1	1	1		1		2	1	**9**	**2**
Chestnut-backed Chickadee	7	7	20	2	15	1	35	4	4	1	**81**	**15**
Dusky Flycatcher	2						1			2	**3**	**2**
Fox Sparrow	15	6	6		8	2	6	3			**35**	**11**
Golden-crowned Sparrow	5	2			1	2		2	2		**8**	**6**
Hammond's Flycatcher	1				1		4	1			**6**	**1**
Lincoln's Sparrow*											**0**	**0**
Western (Pacific-slope) Flycatcher	7	9		3	4	5	5	10	5	5	**21**	**32**
Red-breasted Sapsucker	3	1					2	1	1		**6**	**2**
Rufous Hummingbird	12	4	8	1	3	1	5	3	4	6	**32**	**15**
Steller's Jay	5	6		3	6	1	6	7	4	2	**21**	**19**
Varied Thrush			2		2	4		1	1	1	**5**	**6**
Wilson's Warbler	8		18	4	7	6	22	2	20	6	**75**	**18**
Winter Wren	2	3	2	1		1	3	1	2		**9**	**6**

*One (1) Lincoln's Sparrow captured age undetermined after examination.

Table 4. Capture rate of species captured at the Klamath Bird Observatory constant effort monitoring station at Oregon Caves National Monument 2002-2006 by age-class, season (Breeding, Fall Migration), and year [Capture rate calculated as birds captured per net total hours per season; net hours = number of 12 m nets operated multiplied by time operated in hours; Breeding season = Ten-day periods 4-12, Fall Migration = Ten-day periods 5-18; HY = hatching-year (juvenile, hatched same calendar year), AHY = after-hatching-year (adult, hatched in a previous calendar year)].

	2002				**2003**				**2004**				**2005**				**2006**			
Species	Breeding HY	Breeding AHY	Fall HY	Fall AHY	**Breeding** HY	**Breeding** AHY	**Fall** HY	**Fall** AHY	Breeding HY	Breeding AHY	Fall HY	Fall AHY	**Breeding** HY	**Breeding** AHY	**Fall** HY	**Fall** AHY	Breeding HY	Breeding AHY	Fall HY	Fall AHY
Allen's Hummingbird	0.0027				0.0012				0.0031				0.0014							
American Robin						0.0049					0.0016	0.0016			0.0014		0.0013		0.0013	0.0013
Yellow-rumped (Audubon's) Warbler		0.0027				0.0012				0.0047				0.0029	0.0101	0.0014		0.0067		
Black-headed Grosbeak	0.0040	0.0027			0.0049	0.0024			0.0047	0.0016			0.0086	0.0144			0.0027			
Black-throated Gray Warbler															0.0072		0.0013			
Brown Creeper	0.0040		0.0013			0.0012	0.0012				0.0016		0.0014					0.0013	0.0027	
Cassin's Vireo							0.0012		0.0016		0.0016				0.0014		0.0027		0.0040	
Chestnut-backed Chickadee	0.0053	0.0080	0.0040	0.0013	0.0220	0.0024	0.0024		0.0234	0.0016	0.0000		0.0202	0.0029	0.0303	0.0029	0.0027	0.0013	0.0027	
Downy Woodpecker											0.0016									
Dusky Flycatcher			0.0027												0.0014			0.0027		
Empidonax Flycatcher Sp.													0.0014							
Fox Sparrow			0.0200	0.0080	0.0012		0.0061				0.0125	0.0031			0.0086	0.0043				
Golden-crowned Kinglet	0.0067	0.0053	0.0080	0.0027	0.0061	0.0012	0.0037		0.0016		0.0047		0.0101	0.0058	0.0158		0.0013		0.0214	0.0013
Golden-crowned Sparrow			0.0067	0.0027							0.0016	0.0031				0.0029			0.0027	
Gray Jay	0.0027	0.0013	0.0040	0.0027			0.0012					0.0016		0.0014						0.0013
Green-tailed Towhee						0.0012					0.0016									
Hammond's Flycatcher	0.0013								0.0016				0.0029	0.0014	0.0029					
Hermit Thrush			0.0093	0.0053	0.0012		0.0049	0.0049			0.0140	0.0031			0.0144	0.0029			0.0027	0.0040
Hermit Warbler	0.0053	0.0053			0.0122	0.0012			0.0062	0.0062			0.0086	0.0043	0.0014		0.0027	0.0027		
House Wren					0.0012														0.0013	
Hummingbird Sp.																				
Hutton's Vireo																		0.0013		
Lazuli Bunting																				
Least Flycatcher											0.0016									
Lincoln's Sparrow																				
MacGillivray's Warbler	0.0266	0.0147	0.0013	0.0013	0.0220	0.0122		0.0012	0.0109	0.0094	0.0016	0.0062	0.0173	0.0216	0.0072		0.0107	0.0120	0.0027	

Table 4 continued:

	2002				2003				2004				2005				2006			
Species	Breeding HY	Breeding AHY	Fall HY	Fall AHY	**Breeding** HY	**Breeding** AHY	**Fall** HY	**Fall** AHY	Breeding HY	Breeding AHY	Fall HY	Fall AHY	**Breeding** HY	**Breeding** AHY	**Fall** HY	**Fall** AHY	Breeding HY	Breeding AHY	Fall HY	Fall AHY
Mountain Chickadee													0.0014	0.0000						
Nashville Warbler	0.0253	0.0147			0.0122	0.0135			0.0140				0.0331	0.0144			0.0134	0.0054		
Orange-crowned Warbler	0.0067				0.0073				0.0047		0.0016		0.0029	0.0000	0.0029		0.0013		0.0013	0.0013
Dark-eyed (Oregon) Junco	0.0306	0.0653	0.0107	0.0173	0.0441	0.0441	0.0098	0.0208	0.0281	0.0390	0.0078	0.0156	0.0461	0.0461	0.0519	0.0288	0.0388	0.0295	0.0214	0.0161
Pine Siskin													0.0000	0.0000		0.0029				
Purple Finch		0.0013																		
Red-breasted Nuthatch	0.0133	0.0027			0.0073	0.0012	0.0086	0.0024	0.0125	0.0016			0.0086	0.0058			0.0013	0.0013		0.0027
Red-breasted Sapsucker	0.0040	0.0013											0.0029	0.0014			0.0013			
Northern (Red-shafted) Flicker							0.0012			0.0016									0.0013	
Ruby-crowned Kinglet			0.0053	0.0013			0.0024					0.0016			0.0014	0.0058				0.0013
Ruffed Grouse																				
Rufous Hummingbird	0.0160	0.0053			0.0098	0.0012			0.0047	0.0016			0.0072	0.0043			0.0054	0.0080		
Selasphorus Hummingbird Sp.	0.0013																			
Steller's Jay	0.0027	0.0053	0.0040	0.0027		0.0012		0.0024	0.0016	0.0016	0.0078			0.0043	0.0086	0.0058	0.0013	0.0027	0.0040	
Swainson's Thrush	0.0013	0.0027	0.0013		0.0024	0.0012	0.0061			0.0047	0.0109	0.0031	0.0058	0.0043	0.0086		0.0013		0.0013	0.0013
Townsend's Solitaire		0.0013																		
Townsend's Warbler			0.0013		0.0012				0.0016		0.0016		0.0014		0.0029	0.0014				
Varied Thrush					0.0012		0.0012			0.0031	0.0031	0.0031		0.0014					0.0013	0.0013
Warbler Sp.																				
Warbling Vireo						0.0012			0.0031							0.0014	0.0013			
Western (Pacific-slope) Flycatcher	0.0080	0.0120	0.0013			0.0037			0.0062	0.0078			0.0072	0.0144			0.0054	0.0067	0.0013	
Western Tanager													0.0029		0.0014					
Wilson's Warbler	0.0107				0.0196	0.0012	0.0024	0.0037	0.0078	0.0094	0.0031		0.0144	0.0014	0.0173	0.0014	0.0214	0.0013	0.0054	0.0067
Winter Wren	0.0013	0.0013	0.0013	0.0027		0.0012	0.0024					0.0016	0.0029	0.0014	0.0014		0.0027			
Yellow Warbler															0.0014				0.0013	

Table 5. Capture rates of species captured at the Klamath Bird Observatory constant effort monitoring station at Oregon Caves National Monument 2002-2006 by age-class [Capture rate calculated as birds captured per net hour; net hours = number of 12 m nets operated multiplied by time operated in hours; HY = hatching-year (juvenile, hatched same calendar year), AHY = after-hatching-year (adult, hatched in a previous calendar year)].

	2002		2003		2004		2005		2006	
Species	HY	AHY	HY	AHY	HY	AHY	HY	AHY	HY	AHY
Allens Hummingbird	0.0027	0.0000	0.0012	0.0000	0.0031	0.0000	0.0014	0.0000		
American Robin			0.0000	0.0049	0.0016	0.0016	0.0014	0.0000	0.0027	0.0013
Yellow-rumped (Audubon's) Warbler	0.0000	0.0027	0.0000	0.0012	0.0000	0.0047	0.0101	0.0043	0.0000	0.0067
Black-headed Grosbeak	0.0040	0.0027	0.0049	0.0024	0.0047	0.0016	0.0086	0.0144	0.0027	0.0000
Black-throated Gray Warbler							0.0072	0.0000	0.0013	0.0000
Brown Creeper	0.0053	0.0000	0.0012	0.0012	0.0016	0.0000	0.0014	0.0000	0.0027	0.0013
Cassin's Vireo			0.0012	0.0000	0.0031	0.0000	0.0014	0.0000	0.0067	0.0000
Chestnut-backed Chickadee	0.0093	0.0093	0.0245	0.0024	0.0234	0.0016	0.0504	0.0058	0.0054	0.0013
Downy Woodpecker					0.0016	0.0000				
Dusky Flycatcher	0.0027	0.0000					0.0014	0.0000	0.0000	0.0027
Empidonax Flycatcher Sp.					0.0000	0.0000	0.0014	0.0000		
Fox Sparrow	0.0200	0.0080	0.0073	0.0000	0.0125	0.0031	0.0086	0.0043		
Golden-crowned Kinglet	0.0147	0.0080	0.0098	0.0012	0.0062	0.0000	0.0259	0.0058	0.0228	0.0013
Golden-crowned Sparrow	0.0067	0.0027			0.0016	0.0031	0.0000	0.0029	0.0027	0.0000
Gray Jay	0.0067	0.0040	0.0012	0.0000	0.0000	0.0016	0.0000	0.0014	0.0000	0.0013
Green-tailed Towhee			0.0000	0.0012	0.0016	0.0000				
Hammond's Flycatcher	0.0013	0.0000			0.0016	0.0000	0.0058	0.0014		
Hermit Thrush	0.0093	0.0053	0.0061	0.0049	0.0140	0.0031	0.0144	0.0029	0.0027	0.0040
Hermit Warbler	0.0053	0.0053	0.0122	0.0012	0.0062	0.0062	0.0101	0.0043	0.0027	0.0027
House Wren			0.0012	0.0000					0.0013	0.0000
Hummingbird Sp.									0.0000	0.0000
Hutton's Vireo									0.0000	0.0013
Lazuli Bunting	0.0000	0.0000								
Least Flycatcher					0.0016	0.0000				
Lincoln's Sparrow					0.0000	0.0000				
MacGillivray's Warbler	0.0280	0.0160	0.0220	0.0135	0.0125	0.0156	0.0245	0.0216	0.0134	0.0120
Mountain Chickadee							0.0014	0.0000		
Nashville Warbler	0.0253	0.0147	0.0122	0.0135	0.0140	0.0000	0.0331	0.0144	0.0134	0.0054
Orange-crowned Warbler	0.0067	0.0000	0.0073	0.0000	0.0062	0.0000	0.0058	0.0000	0.0027	0.0013
Dark-eyed (Oregon) Junco	0.0413	0.0826	0.0539	0.0649	0.0359	0.0546	0.0980	0.0749	0.0602	0.0455
Pine Siskin							0.0000	0.0029		
Purple Finch	0.0000	0.0013								
Red-breasted Nuthatch	0.0133	0.0027	0.0159	0.0037	0.0125	0.0016	0.0086	0.0058	0.0013	0.0040
Red-breasted Sapsucker	0.0040	0.0013					0.0029	0.0014	0.0013	0.0000
Northern(Red-shafted) Flicker			0.0012	0.0000	0.0000	0.0016			0.0013	0.0000
Ruby-crowned Kinglet	0.0053	0.0013	0.0024	0.0000	0.0000	0.0016	0.0014	0.0058	0.0000	0.0013
Ruffed Grouse									0.0000	0.0000
Rufous Hummingbird	0.0160	0.0053	0.0098	0.0012	0.0047	0.0016	0.0072	0.0043	0.0054	0.0080
Selasphorus Hummingbird Sp.	0.0013	0.0000					0.0000	0.0000		
Steller's Jay	0.0067	0.0080	0.0000	0.0037	0.0094	0.0016	0.0086	0.0101	0.0054	0.0027
Swainson's Thrush	0.0027	0.0027	0.0086	0.0012	0.0109	0.0078	0.0144	0.0043	0.0027	0.0013
Townsend's Solitaire	0.0000	0.0013								
Townsend's Warbler	0.0013	0.0000	0.0012	0.0000	0.0031	0.0000	0.0043	0.0014		
Varied Thrush			0.0024	0.0000	0.0031	0.0062	0.0000	0.0014	0.0013	0.0013
Warbler Sp.							0.0000	0.0000		
Warbling Vireo			0.0000	0.0012	0.0031	0.0000	0.0000	0.0014	0.0013	0.0000
Western (Pacific-slpe) Flycatcher	0.0093	0.0120	0.0000	0.0037	0.0062	0.0078	0.0072	0.0144	0.0067	0.0067
Western Tanager							0.0043	0.0000		
Wilson's Warbler	0.0107	0.0000	0.0220	0.0049	0.0109	0.0094	0.0317	0.0029	0.0268	0.0080
Winter Wren	0.0027	0.0040	0.0024	0.0012	0.0000	0.0016	0.0043	0.0014	0.0027	0.0000
Yellow Warbler							0.0014	0.0000	0.0013	0.0000

Table 6. Productivity of birds captured at Oregon Caves National Monument constant effort monitoring station at 2002-2006, calculated as the ratio of capture rates of locally produced young to breeding adults. Species and years for which adults and locally-produced young were not captured (i.e., those for which productivity could not be calculated) are excluded.

Species	2002	2003	2004	2005	2006
American Robin					1.00
Yellow-rumped (Audubon's) Warbler				0.67	
Black-headed Grosbeak				0.75	
Chestnut-backed Chickadee	0.40			1.00	
Golden-crowned Kinglet	0.50	4.00		0.80	
Gray Jay	1.00				
Hermit Thrush		1.00			
Hermit Warbler	0.25			1.00	
MacGillivray's Warbler	0.20			0.42	0.25
Nashville Warbler	0.78			1.27	1.00
Dark-eyed (Oregon) Junco	0.33	0.82	0.78	1.08	1.04
Western (Pacific-slope) Flycatcher	1.67		1.00	1.50	1.00
Red-breasted Nuthatch	3.00			3.00	1.00
Red-breasted Sapsucker	3.00				
Steller's Jay	0.25		1.00	0.80	2.00
Swainson's Thrush		2.00		1.00	
Wilson's Warbler					2.00

Appendix A. Conservation status species detected during Klamath Bird Observatory monitoring efforts at Oregon Caves National Monument 2002-2006.

	OR/WA PIF[1]	Continental PIF[2]	ODFW Conservation Strategy[3]
Common Name	Conifer Forests, W. OR & WA	Intermoun-tain West & Pacific Avifaunal Biomes	Klamath Mts.
Allen's Hummingbird		X	
Black-throated Gray Warbler		X	
Blue Grouse		X	
Brown Creeper	X		
Chestnut-backed Chickadee		X	
Dusky Flycatcher		X	
Fox Sparrow		X	
Golden-crowned Sparrow		X	
Green-tailed Towhee		X	
Hammond's Flycatcher	X		
Hermit Warbler	X	X	
Lincoln's Sparrow	X		
Mountain Quail		X	
Olive-sided Flycatcher		X	X
Western (Pacific-slope) Flycatcher	X	X	
Pileated Woodpecker	X		
Red-breasted Sapsucker		X	
Rufous Hummingbird		X	
Steller's Jay		X	
Varied Thrush	X	X	
Wilson's Warbler	X		
Winter Wren	X	X	

[1]Altman, B. 1999. Version 1.0. Conservation strategy for landbirds in coniferous forests of western Oregon and Washington. Oregon-Washington Partners in Flight. http://www.orwapif.org/pdf/western_forest.pdf;

[2] Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will, 2004. Partners in Flight North American Landbird Conservation Plan. Cornell lab of Ornithology. Ithaca, New York.

[3] Oregon Department of Fish and Wildlife. 2006. Oregon Conservation Strategy. Oregon Department of Fish and Wildlife, Salem, Oregon.

Appendix B. Ten-day periods used in constant effort monitoring station scheduling and capture data analyses with corresponding calendar dates.

Ten-day cycle #	Calendar dates
1	1 May-10 May
2	11 May-20 May
3	21 May-30 May
4	31 May-9 June
5	10 June-19 June
6	20 June-29 June
7	30 June-9 July
8	10 July-19 July
9	20 July-29 July
10	30 July-8 August
11	9 August-18 August
12	19 August-28 August
13	29 August-7 September
14	8 September-17 September
15	18 September-27 September
16	28 September-7 October
17	8 October-17 October
18	18 October-27 October

Appendix C. English common and scientific names of bird species mentioned in *Report to the National Park Service Klamath Network on Bird Monitoring Efforts by the Klamath Bird Observatory in the Oregon Caves National Monument 2002-2006*.

Common Name	*Scientific Name*
Allen's Hummingbird	*Selasphorus sasin*
American Robin	*Turdus migratorius*
Yellow-rumped (Audubon's) Warbler	*Dendroica coronata auduboni*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Black-throated Gray Warbler	*Dendroica nigrescens*
Brown Creeper	*Certhia americana*
Cassin's Vireo	*Vireo cassinii*
Chestnut-backed Chickadee	*Poecile rufescens*
Downy Woodpecker	*Picoides pubescens*
Dusky Flycatcher	*Empidonax oberholseri*
Fox Sparrow	*Passerella iliaca*
Golden-crowned Kinglet	*Regulus satrapa*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Gray Jay	*Perisoreus canadensis*
Green-tailed Towhee	*Pipilo chlorurus*
Hammond's Flycatcher	*Empidonax hammondii*
Hermit Thrush	*Catharus guttatus*
Hermit Warbler	*Dendroica occidentalis*
House Wren	*Troglodytes aedon*
Hutton's Vireo	*Vireo huttoni*
Lazuli Bunting	*Passerina amoena*
Least Flycatcher	*Empidonax minimus*
Lincoln's Sparrow	*Melospiza lincolnii*
MacGillivray's Warbler	*Oporornis tolmiei*
Mountain Chickadee	*Poecile gambeli*
Mountain Quail	*Oreortyx pictus*
Nashville Warbler	*Vermivora ruficapilla*
Orange-crowned Warbler	*Vermivora celata*
Dark-eyed (Oregon) Junco	*Junco h. oregonus*
Western (Pacific-slope) Flycatcher	*Empidonax difficilis*
Pine Siskin	*Carduelis pinus*
Purple Finch	*Carpodacus purpureus*
Red-breasted Nuthatch	*Sitta canadensis*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Northern (Red-shafted) Flicker	*Colaptes a. cafer*
Ruby-crowned Kinglet	*Regulus calendula*
Ruffed Grouse	*Bonasa umbellus*
Rufous Hummingbird	*Selasphorus rufus*
Steller's Jay	*Cyanocitta stelleri*
Swainson's Thrush	*Catharus ustulatus*
Townsend's Solitaire	*Myadestes townsendi*
Townsend's Warbler	*Dendroica townsendi*
Varied Thrush	*Ixoreus naevius*
Warbling Vireo	*Vireo gilvus*
Western Tanager	*Piranga ludoviciana*
Wilson's Warbler	*Wilsonia pusilla*
Winter Wren	*Troglodytes troglodytes*
Yellow Warbler	*Dendroica petechia*